

September 19, 2005

Mr. David A. Christian
Sr. Vice President and Chief Nuclear Officer
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Innsbrook Technical Center
5000 Dominion Blvd.
Glen Allen, Virginia 23060-6711

SUBJECT: NORTH ANNA POWER STATION, UNITS 1 AND 2 - RESPONSE TO NRC
BULLETIN 2003-01, "POTENTIAL IMPACT OF DEBRIS BLOCKAGE ON
EMERGENCY SUMP RECIRCULATION AT PRESSURIZED WATER
REACTORS" (TAC NO. MB9590 AND MB9591)

Dear Mr. Christian:

This letter acknowledges receipt of the Virginia Electric and Power Company (VEPCO) response dated August 7, 2003, to Nuclear Regulatory Commission (NRC) Bulletin 2003-01, "Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized Water Reactors," dated June 9, 2003. The NRC issued Bulletin 2003-01 to all pressurized-water reactor licensees requesting that they provide a response, within 60 days of the date of the Bulletin, that contains either the information requested in Option 1 or Option 2 as stated in Bulletin 2003-01:

- Option 1: State that the ECCS [emergency core cooling system] and CSS [containment spray system] recirculation functions have been analyzed with respect to the potentially adverse post-accident debris blockage effects identified in . . . the Discussion section, and are in compliance with all existing applicable regulatory requirements.
- Option 2: Describe any interim compensatory measures that have been implemented or that will be implemented to reduce the risk which may be associated with potentially degraded or nonconforming ECCS and CSS recirculation functions until an evaluation to determine compliance is complete. If any of the interim compensatory measures listed in the Discussion section will not be implemented, provide a justification. Additionally, for any planned interim measures that will not be in place prior to your response to this bulletin, submit an implementation schedule and provide the basis for concluding that their implementation is not practical until a later date.

VEPCO's letter provided an Option 2 response.

Bulletin 2003-01 discussed six categories of interim compensatory measures (ICMs): (1) operator training on indications of and responses to sump clogging; (2) procedural modifications if appropriate, that would delay the switchover to containment sump recirculation (e.g., shutting down redundant pumps that are not necessary to provide required flows to cool the containment and reactor core, and operating the CSS intermittently); (3) ensuring that

alternative water sources are available to refill the RWST [refueling water storage tank] or to otherwise provide inventory to inject into the reactor core and spray into the containment atmosphere; (4) more aggressive containment cleaning and increased foreign material controls; (5) ensuring containment drainage paths are unblocked; and (6) ensuring sump screens are free of adverse gaps and breaches.

In its bulletin response dated August 7, 2003, VEPCO stated that it had implemented the following interim compensatory measures at North Anna Power Station, Units 1 and 2:

- (1) for small loss-of-coolant accident (LOCAs), where pressurizer pressure remains above the shutoff head of the low head safety injection (LHSI) pumps, systematic reduction in operating ECCS trains, and charging pumps are realigned from ECCS injection to the normal charging lineup - ICM category #2;
- (2) refill of the RWST if the normal recirculation path is lost due to debris blockage - ICM category #3;
- (3) cross connecting to the non-faulted unit's charging system to assist in core cooling - ICM category #3;
- (4) the availability of a post-LOCA cooldown and depressurization procedure which may allow avoidance of the recirculation mode - ICM category #2;
- (5) two independent senior reactor operator containment closeout inspections of cleanliness and the cleanup of foreign material/loose debris, including in normally inaccessible areas, with follow-up inspections until the containment is declared free of dirt and foreign material - ICM category #4;
- (6) containment closeout verifications that the reactor cavity transfer canal drain path is open - ICM category #5;
- (7) an administrative procedure to provide approval and implementation guidelines for sub-atmospheric containment entry, including instructions to inspect entry and work areas for loose debris which may clog the cavity drains or the recirculation sump itself, and requirements that equipment remaining in containment must be approved by Station Engineering and the Station Nuclear Safety and Operating Committee - ICM category #4 and ICM category #5; and
- (8) refueling outage test procedures to provide a comprehensive sump screen inspection against sump screen design requirements, the use of which would detect gaps or breaches and would initiate corrective actions - ICM category #6.

In addition, VEPCO stated it would be implementing the following interim compensatory measures:

- (1) procedural enhancements for continuous monitoring of key sump performance indicators to ensure, and streamlining of debris blockage identification instructions and alternate core cooling source prioritizations by March 31, 2004, - ICM category #1; and

(2) licensed operator briefings on Bulletin 2003-01 issues, key sump performance indicators to be monitored during an accident, identification of sump blockage using the indicators, and procedures that respond to debris blockage by August 22, 2003, - ICM category #1.

VEPCO further stated in its response that any changes involving preemptive operator actions to shut off one train of ECCS would be considered after the Westinghouse Owners Group (WOG) evaluation of the generic impact of the changes. In that regard, VEPCO stated, including justifications, that it would not be implementing the following interim compensatory measure: preemptive operator actions to shut off one train of ECCS or quench spray to preserve RWST inventory prior to transfer to sump recirculation.

On October 29, 2004, VEPCO provided its response to an NRC staff request for additional information (RAI) dated September 2, 2004. In its response, VEPCO described enhancements to the North Anna Emergency Operating Procedures (EOPs) that would decrease risk associated with potential sump blockage, while not impacting the current symptom-based response strategies in the EOPs. These enhancement were to:

(1) provide for continuous monitoring of key sump performance indicators to ensure transfer to the loss of emergency coolant recirculation procedure on indications of pump cavitation due to debris blockage of the sump - ICM category #1; and

(2) streamline the instructions in the loss of emergency coolant recirculation procedure to identify debris blockage as the reason for the loss of recirculation and to prioritize sources of alternate core cooling - ICM category #1.

In its response dated October 29, 2004, VEPCO stated that it had implemented the EOP changes with appropriate training before March 31, 2004, having modified EOPs ES 1.3 "Transfer to Cold Leg Recirculation," and ECA 1.1, "Loss of Emergency Coolant Recirculation. VEPCO stated that it had performed plant simulator validation runs with multiple operator teams to simulate a loss of sump recirculation after a LOCA, exercising the recent EOP changes and demonstrating a consistent level of response from control room operators - ICM category #1.

By letter dated October 29, 2004, VEPCO stated that, subsequent to the implementation of these EOP changes, in March 2004, the WOG published WCAP-16204, "Evaluation of Potential ERG and EPG Changes to Address NRC Bulletin 2003-01 Recommendations (PA-SEE-0085), Revision 1," and that the WOG recommendation was to implement a Westinghouse-Specific Sump Blockage Control Room Guideline (SBCRG) from WCAP-16204, Volume II as an interim compensatory action to reduce the potential risk associated with sump blockage. VEPCO stated that the SBCRG, as a generic procedure outside of the ERG network of procedures, identified seven major actions to be performed in response to loss of a sump recirculation in a Westinghouse plant with a large dry containment (protect ECCS and CSS pumps, establish and maintain optimum emergency coolant flow, increase/conservate RWST level, initiate cooldown to cold shutdown, depressurize the reactor coolant system (RCS) to minimize RCS subcooling, depressurize steam generators to cool down and depressurize the RCS, and maintain RCS heat removal). In addition, VEPCO reviewed the SBCRG and concluded that the March 2004, EOP changes at North Anna addressed the issues covered by the SBCRG, and that no additional compensatory measures related to EOPs were being implemented at North Anna.

On May 17, 2005, VEPCO provided its response to a March 31, 2005, supplemental RAI. In its response, VEPCO noted that North Anna has a large, dry subatmospheric containment design with ECCS and containment heat removal systems that are specific to that kind of containment, and, therefore, there are several non-trivial system differences compared to the Westinghouse reference plant that was used for the evaluations in Volume I of WCAP-16204, Revision 1.

Table 1 of the May 17, 2005, submittal summarized VEPCO's evaluation of each candidate operator Action (COA) from Volume 1 of WCAP-16204, Revision 1 as follows:

- (1) COA A1a, "Operator Action to Secure One Spray Pump," would not be implemented at North Anna because the containment fan coolers are non-safety related components located in the basement of the containment and would be flooded as the containment fills with water during a LOCA, and because continuous operation of the containment spray system is credited in the radiological analysis for the design basis LOCA (and failure of the single remaining running pump could result in a significant increase in offsite dose while providing no appreciable delay in transfer to recirculation);
- (2) COA A1b, "Operator Action to Secure Both Spray Pumps," would not be implemented at North Anna because the containment fan coolers are non-safety related components located in the basement of the containment and would be flooded as the containment fills with water during a LOCA, and because continuous operation of the containment spray system is credited in the radiological analysis for the design basis LOCA;
- (3) COA A2, "Manually Establish One Train of Containment Sump Recirculation Prior to Automatic Actuation," would not be implemented because the LHSI pump net-positive suction head margin was considered too small to support early switchover to sump recirculation;
- (4) COA A3, "Terminate One Train of Safety Injection After Recirculation Alignment," would not be implemented because a failure of the running injection pump could result in a significant increase in peak cladding temperature and increase the radiological dose to the public from a LOCA event;
- (5) COA A4, "Early Termination of One LPSI/RHR Pump Prior to Recirculation Alignment," would not be implemented because this action could increase the probability of interrupting all safety injection flow;
- (6) COA A5, "Refill of Refueling Water Storage Tank," had already been implemented since the North Anna EOPs include guidance to refill the RWST using borated sources - ICM category #3;
- (7) COA A6, "Inject More Than One RWST Volume From a Refilled RWST or By Bypassing the RWST," had already been implemented in that the North Anna EOPs and Severe Accident Management Guidelines include operator guidance for using the opposite unit RWST as an alternate supply of core cooling (after the beyond design basis condition of complete loss of recirculation) - ICM category #3;
- (8) COA A7, "Provide More Aggressive Cooldown and Depressurization Following a Small Break LOCA," had already been implemented in that the North Anna EOPs, which are

consistent with the WOG ERGs, include guidance for aggressive cooldown and depressurization - ICM category #2;

(9) COA A8, "Provide Guidance on Symptoms and Identification of Containment Sump Blockage," had already been implemented in the North Anna EOPs based on the changes completed in March 2004 which provided operators with multiple diverse indicators of containment sump blockage, and related operator training addressed symptoms and identification of sump blockage - ICM category #1;

(10) COA A9, "Develop Contingency Actions in response to Containment Sump Blockage, Loss of Suction, and Cavitation," had already been implemented in the North Anna EOPs based on the changes completed in March 2004 which included the seven major actions outlined in the SBCRG, and simulator scenarios of a loss of recirculation capability due to sump blockage were conducted with multiple operator teams to confirm the validity and efficacy of the EOP changes - ICM category #1;

(11) COA A10, "Early Termination of One Train of HPSI/High-head Injection Prior to Recirculation Alignment," was not implemented since it was applicable to Combustion Engineering design plants unlike North Anna's Westinghouse design; and

(12) COA A11, "Prevent or Delay Containment Spray for Small Break LOCAs in Ice Condenser Plants," was not applicable to North Anna, which has a large dry subatmospheric containment.

On August 26, 2005, VEPCO provided its response to a July 13, 2005, conference call with the NRC staff. In its letter, VEPCO stated that for COA A5, "Refill of Refueling Water Storage Tank," the EOPs direct cross connection to the non-faulted North Anna unit's RWST upon the event of emergency sump blockage, with refill of the faulted unit's RWST initiated when the faulted unit's RWST is being used for injection - ICM category #3.

The NRC staff has considered VEPCO's Option 2 response for compensatory measures that were or were to have been implemented to reduce the interim risk associated with potentially degraded or nonconforming ECCS and CSS recirculation functions. Based on your response, the NRC staff considers your actions to be responsive to and meet the intent of Bulletin 2003-01. Please retain any records of your actions in response to Bulletin 2003-01, as the NRC staff may conduct subsequent inspection activities regarding this issue.

- 6 -

Should you have any questions, please contact me at 301-415-1544 or the lead PM for this issue, Alan Wang at 301-415-1445.

Sincerely,

/RA/

Stephen R. Monarque, Project Manager, Section 1
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Office of Nuclear Reactor Regulation

Docket Nos. 50-338 and 50-339

cc: See next page

Should you have any questions, please contact me at 301-415-1544 or the lead PM for this issue, Alan Wang at 301-415-1445.

Sincerely,

/RA/

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